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ABSTRACT

Results are presented of a study determining the effects of type of junior high school science program on science content achievement and science process achievement in the presence of reading achievement, mathematics achievement, and sex. Two groups of ninth-grade students (N=50) were randomly selected to participate in either an ISCS program or a traditional high school program for three years. Measures of achievement in science content, mathematics, and reading were determined from the SRA Achievement Series; and achievement in the use of science process skills was determined from scores on the Comprehensive Test of Basic Skills - Science. Findings include the results that the type of science program accounted for only 1% of the variability in science content achievement; it also failed to account for any of the variability in science process achievement when the variance shared with sex, reading achievement, and mathematics achievement was removed. (Author/CS)

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EFFECTS OF TYPE OF JUNIOR HIGH SCHOOL SCIENCE PROGRAM ON SCIENCE CONTENT ACHIEVEMENT AND SCIENCE PROCESS ACHIEVEMENT

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Abstract

This research was conducted to determine the effect of type of junior high school science program (ISCS and traditional) on science content achievement and science process achievement in the presence of reading achievement, mathematics achievement, and sex.

The subjects for this study were selected at random from a population of ninth-grade students in two midwestern junior high schools in a large suburban school district. All the subjects were enrolled for three consecutive years in either the ISCS program (N = 50) or a traditional junior high school program (N = 50).

The SRA Achievement Series, Multilevel Edition, Red Level was used to obtain the measures of achievement in science content, mathematics, and reading. Achievement in the use of science process skills was determined from scores on the Comprehensive Test of Basic Skills: Science. Multiple regression analysis was used to analyze the data. The significance level was set at .05.

Students in ISCS and traditional science did not differ significantly on either the science content achievement or the science process achievement variables, when the variables reading achievement, mathematics achievement, and sex were held constant. The type of science program accounted for only 1% of the variability in science content achievement

and failed to account for any of the variability in science process achievement, when the variance shared with sex, reading achievement, and mathematics achievement was removed.

The new curriculum materials developed for junior high school science in recent years have stressed the development of science process skills. These skills are described as methods for acquiring and organizing knowledge about the environment and include activities such as observing, measuring, inferring, predicting, formulating hypotheses, defining operationally, experimenting, collecting and interpreting data, and formulating models (Gallagher, 1971). The importance of teaching these skills has been emphasized by many science educators (Gagne, 1963; Hurd, 1970; Koran, 1970; Renner, 1964; Sund and Trowbridge, 1973). The new curriculum materials stressed these skills and therefore differed from the pre-existing traditional science courses which tended to place more emphasis upon science as a body of information to be learned.(Hurd, 1970)

The Intermediate Science Curriculum Study (ISCS) is one of the newer science programs developed for the junior high school. Its rationale indicates that emphasis is placed upon both the concepts of science and the processes of scientific inquiry (Burkman, 1970). Thus, students who complete this program may be expected to become more proficient in the use of science process skills.

This study sought to compare student achievement in ISCS and traditional science classes. Achievement was

compared in science content (factual information) and in science process skill development. Few studies have compared ISCS and traditional groups on science content. Matherne (1977) found that the traditional group scored higher than the ISCS group on a test of factual information. Previous studies related to science process skill achievement have been reported, with little or no differences shown (Heffernan, 1973; Matherne, 1977; Stallings and Snyder, 1977).

The emphasis of this study has been to investigate the effects of type of science program (ISCS or traditional) on science content achievement and science process achievement when selected student variables are held constant.

Method

The subjects for this study were randomly selected from a population of ninth-grade students in two midwestern junior high schools of a large suburban school district. All subjects were enrolled for three consecutive years in either the ISCS program (N = 50) or a traditional junior high school program (N = 50). The enrollment at both junior high schools was comprised predominantly of students from the middle to upper-middle social class.

The Comprehensive Test of Basic Skills: Science, Expanded Edition, Level 3 was administered to all subjects.

Scores from this instrument were used as the measure of science process achievement (The Eighth Mental Measurements Yearbook, 1978). The reading, mathematics, and science achievement scores on the SRA Achievement Series, Multilevel Edition, Red Level were obtained from student records. Science achievement scores on this instrument were used as the measure of science content achievement (Funk, 1977). The KR-20 reliability of all achievement measures exceeded .89 (CTBS Examiner's Manual, 1974; Using Test Results: A Teacher's Guide, 1972).

Results

The means and standard deviations of the raw scores for the ISCS and traditional groups on the four achievement variables are presented in Table 1.

Multiple regression analysis was used to determine the effect of type of science program on science content achievement and science process achievement. The significance level was set at .05 for all tests.

Full and reduced regression models were developed to analyze the effect of the type of science program on science content achievement. The full model contained the criterion variable science content achievement and the independent variables of sex, reading achievement, mathematics achievement, and type of science program. The reduced model was formed by deleting the type of science program variable.

TABLE 1

MEANS AND STANDARD DEVIATIONS FOR THE ISCS AND TRADITIONAL GROUPS

Variable	ISCS		Traditional	
	Mean	SD	Mean	SD
Science content	37.7	6.5	35.8	8.2
Science Process	31.9	5.2	31.6	5.7
Reading	67.4	12.4	64.6	15.3
Mathematics	49.3	12.5	51.5	13.9

The results for the regression analysis for these two models are displayed in Table 2.

The drop in R^2 from the full model to the reduced model was .01 for 1 and 95 degrees of freedom. This indicates that the type of science program independently accounted for one percent of the original variability in science content achievement scores when the variance shared with sex, reading achievement, and mathematics achievement was removed. The probability of this variance having occurred by chance was .116. Therefore, there was no significant difference in science content achievement according to the type of science program when the variables of sex, reading achievement, and mathematics achievement were held constant.

Full and reduced regression models were also developed to test the effect of the type of science program on science process achievement. The full model consisted of the criterion variable science process achievement and the independent variables of sex, reading achievement, mathematics achievement, and type of science program. The type of science program variable was again deleted from the reduced model. The results for the regression analysis for these two models are provided in Table 3.

The drop in R^2 from the full model to the reduced model was .00 for 1 and 95 degrees of freedom. This indicates that

TABLE 2

RESULTS OF REGRESSION ANALYSES FOR FULL AND REDUCED MODELS

SHOWING RELATIONSHIP OF TYPE OF SCIENCE PROGRAM WITH THE CRITERION VARIABLE OF SCIENCE CONTENT ACHIEVEMENT

	Models			
	(Full)		(Reduced)	
Independent Variables	Beta wt	b wt	Beta wt	b wt
Reading achievement	.54	.29	.57	.30
Mathematics achievement	.32	.18	.30	.17
Sex	.25	3.74	.25	3.72
Type of program	.09	1.36		
Regression constants		6.05		6.51

R^2 Full	.70	DFN/DFD*	1/95
R^2 Reduced	.69	F ratio	2.459
R^2 Difference	.01	Probability	.116

* DFN/DFD = Degrees Freedom Numerator/
Degrees Freedom Denominator

TABLE 3

RESULTS OF REGRESSION ANALYSES FOR FULL AND REDUCED MODELS SHOWING RELATIONSHIP OF TYPE OF SCIENCE PROGRAM WITH THE CRITERION VARIABLE OF SCIENCE PROCESS ACHIEVEMENT

	Models			
	(Full)		(Reduced)	
Independent Variables	Beta wt	b wt	Beta wt	b wt
Reading achievement	.47	.18	.47	.18
Mathematics achievement	.39	.16	.39	.16
Sex	.23	2.52	.23	2.52
Type of program	.00	.00		
Regression constants		10.33		10.33

R^2 Full	.65	DFN/DFD*	1/95
R^2 Reduced	.65	F ratio	.000
R^2 Difference	.00	Probability	1.000

*DFN/DFD = Degrees Freedom Numerator/
Degrees Freedom Denominator

the type of science program failed to account for any of the original variability in science process achievement scores when the variance shared with sex, reading achievement, and mathematics achievement was removed. The probability of no variance having occurred by chance was 1.000. Therefore, no significant difference was found in science process achievement when the variables of sex, reading achievement, and mathematics achievement were held constant.

Summary

The type of science program (ISCS or traditional) had no significant effect on science content achievement in this study (as measured by the SRA Achievement Series) when the variables of sex, reading achievement, and mathematics achievement were held constant. Further, the type of science program independently accounted for only one percent of the original variability in the science content achievement scores.

No significant difference was found between the groups on science process achievement in this study (as measured by the Comprehensive Test of Basic Skills: Science) when the variables of sex, reading achievement, and mathematics achievement were held constant. The type of science program failed to account for any of the variability in the science process achievement scores when the variance shared with sex, reading achievement, and mathematics achievement was removed.

Within the context of this study, the type of science program seems to have a very small relationship to science content or science process achievement. Students in ISCS science were as knowledgable in science content as students in the traditional science classes. Also, anticipated gains in the use of science process skills by students in the ISCS program were not demonstrated in this study.

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